

## SUPPLEMENTAL CURED-IN-PLACE PIPE (CIPP) LINING SPECIFICATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. It is the intent of this specification to provide for the reconstruction of pipelines by the installation of a resin-impregnated flexible tube that is inverted into the original pipeline and expanded to fit tightly against said pipeline. The finished cured-in-place pipe (CIPP) shall be such that when the thermosetting resin cures, the total wall thickness shall be a homogenous and monolithic felt and resin composite matrix, chemically resistant to withstand internal exposure to stormwater.
- B. All products supplied and all work performed shall be in accordance with The Facility Owner's Standard Specifications, applicable standards from American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), GDOT Utility Accommodation Policy and Standards, and the Georgia Environmental Protection Division (EPD) Guidelines for Sewage Collection Systems. Latest revisions of all standards shall apply.
- C. Related Requirements:
  - 1. GDOT Specification 660 – Sanitary Sewers
    - a. Special Provision Section 660 (dated 11/13/14 or most recent version)
  - 2. GDOT Specification 936 - CCTV
  - 3. NASSCO Cured in Place Pipe (CIPP) Installation Performance Specification Guideline

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. CIPP Pipe Lining:
  - 1. Basis of Measurement: By linear foot, measured from center of manhole to center of manhole.
  - 2. Basis of Payment: Includes pipe cleaning and flushing, pre- and post- TV inspection and videography, liner installation, water for inversion, disposal of water, pipe gaskets (end seals), testing of liner, and cure tracking technology as specified below.

#### 1.3 REFERENCE STANDARDS

- A. ASTM International:
  - 1. ASTM D5260 - Standard Classification for Chemical Resistance of Poly (Vinyl Chloride) (PVC) Homopolymer and Copolymer Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
  - 2. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
  - 3. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - 4. ASTM D1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

5. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
6. ASTM D5813 - Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems.
7. ASTM F1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.
8. ASTM F1743 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP).
9. ASTM F2019 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP).
10. ASTM F2599 Standard Practice for Sectional Repair of Damaged Pipe by Means of an Inverted Cured-In-Place Liner.
11. ASTM F3240 - Standard Practice for Installation of Seamless Molded Hydrophilic Gaskets for Long-Term Watertightness of Cured-In-Place Rehabilitation of Main and Lateral Pipelines.

#### 1.4 SUBMITTALS

##### A. Product Data:

1. Submit manufacturer information regarding liner material, curing chemicals, and lubricants. Include fabric tube, flexible membrane coating, resins, and pre-liner.
2. Submit complete description of proposed wet-out procedures.
3. All MSDS sheets for materials to be furnished on the project.
4. Fabric tube shall be accompanied by minimal void volume in the felt that will be filled with resin.
5. Submit copy of wet out report and manufacturers recommended cure schedule for each liner.
6. Submit liner thickness basis of design including all calculations and selection criteria for the products being supplied.

##### B. Shop Drawings: Indicate liner dimensions for each pipe size to be relined.

##### C. Samples: Submit two samples of liner material in both uncured and cured state. For each inversion length, cured sample should be cut from termination point that has been inverted through a like diameter pipe held in place by a suitable heat sink. Sample shall be provided to third party testing agency by Contractor.

##### D. Pipe Inspection and Reporting:

1. Submit video recordings of piping sections as follows:
  - a. Pre CCTV inspection showing condition of existing pipe and pipe joints after cleaning and prior to relining.
  - b. Post CCTV inspection showing cured liner, if applicable, after relining Work has been completed.
  - c. Pre and post CCTV inspection shall be performed in current NASSCO PACP format.
  - d. Videos shall be provided via USB in Granite XP format.
2. Reporting
  - a. Provide pre- and post- CCTV inspection reports in hard copy and electronic format (.pdf).

- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for liner thickness.
- G. Test and Evaluation Reports: Submit reports certifying that liner material meets ASTM testing standards as specified in this Section.
- H. Manufacturer Instructions:
  - 1. Submit detailed description of liner placement and curing procedures for piping.
  - 2. Include description of procedures for sealing liner material at manholes and reestablishing service connections.
  - 3. Submit manufacturer's requirements for receiving, handling, and storage of materials.
- I. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
- J. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections. Contractor shall provide testing as indicated by the Engineer. Contractor shall be responsible for costs associated with testing. Contractor shall employ 3<sup>rd</sup> party testing agency qualified to perform said work. Tests shall be conducted on flexural modulus, flexural strength, and wall thickness with test method D790.
- K. Qualifications Statements:
  - 1. Submit qualifications for manufacturer, installer, licensed professional, pipeline assessor.
  - 2. Submit manufacturer's approval of installer.
- L. A detailed Notification Plan including staged notification to residents affected by the CIPP installation. The Installation Contractor shall notify all residents affected by this construction at least 24 hours prior to any service disruption affecting their service connection. The Installation Contractor shall make every effort to maintain service usage throughout the duration of the project.
- M. Safety Plan, per NASSCO guidelines:
  - 1. The Contractor shall conform to all work safety requirements of pertinent regulatory agencies, and shall secure the site for the working conditions in compliance with the same. The Contractor shall erect such signs and other devices as are necessary for the safety of the work site.
  - 2. The Contractor shall perform all of the Work in accordance with applicable OSHA standards. Emphasis shall be placed upon the requirements for entering confined spaces and with the equipment being utilized for pipe renewal.
  - 3. The Contractor shall submit a proposed Safety Plan to the Owner, prior to beginning any work, identifying all competent persons. The plan shall include a description of a daily safety program for the job site and all emergency procedures to be implemented in the event of a safety incident. All work shall be conducted in accordance with the Contractor's submitted Safety Plan.
  - 4. Compensation for all work required for the submittal of the Safety Plan shall be included in the various pipelining items contained in the Proposal
- N. Quality Control Plan (QCP), per NASSCO guidelines:

1. A detailed quality control plan (QCP) shall be submitted to the Owner that fully represents and conforms to the requirements of these specifications. At a minimum the QCP shall include the following:
  - a. A detailed discussion of the proposed quality controls to be performed by the Contractor.
  - b. Defined responsibilities, of the Contractor's personnel, for assuring that all quality requirements for this contract are met. These shall be assigned, by the Contractor, to specific personnel.
  - c. Proposed procedures for quality control, product sampling and testing shall be defined and submitted as part of the plan.
  - d. Proposed methods for product performance controls, including method of and frequency of product sampling and testing both in raw material form and cured product form.
  - e. Scheduled performance and product test result reviews between the Contractor and the Owner at a regularly scheduled job meeting.
  - f. Inspection forms and guidelines for quality control inspections shall be prepared in accordance with the standards specified in this contract and submitted with the QCP.

O. Cure Tracking Technology

1. Submit reports for all sections of pipe which will be cured in place.
2. Reports shall include continuous data from the start of the curing process throughout the completion of the curing process.

## 1.5 QUALITY ASSURANCE

- A. Perform Work according to manufacturer's standards and NASSCO CIPP Installation Guidelines (2017).
- B. Maintain one copy of each standard affecting Work of this Section on Site.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience in installation of liner materials and certified by manufacturer.
  1. Minimum of 50,000 feet of similar pipe size and length installed in the U.S.
- C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Georgia.
- D. Pipeline Assessor:
  1. Person specializing in assessing condition of sewer pipelines prior to and following relining.
  2. Currently certified in Pipeline Assessment and Certification Program (PACP) of the National Association of Sewer Service Companies (NASSCO).
  3. Provide certification status.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store materials according to manufacturer instructions. The CIPP shall be vacuum impregnated with resin not more than 120 hours before the time of installation and stored out of direct sunlight at a temperature of less than 70° F.
- C. The Installation Contractor shall deliver the resin impregnated CIPP tube to the site and provide all equipment required to insert and cure the CIPP within the host pipe. The Installation Contractor shall designate a location where the CIPP tube will be vacuum impregnated with the resin prior to installation. If requested by the Owner, the Installation Contractor shall notify the Engineer at least 48 hours prior to wet out to allow the Engineer to observe the materials and wet out procedure. All procedures to prepare the CIPP for installation shall be in strict accordance with the Manufacturer's recommendations.
- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.

## 1.8 EXISTING CONDITIONS

- A. Field Measurements:
  - 1. Contractor shall verify field measurements prior to fabrication such as diameter and length.
  - 2. Indicate field measurements on Shop Drawings.

## 1.9 WARRANTY

- A. Furnish three-year manufacturer's warranty for liner.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Design lining material to have sufficient structural strength to support dead loads, live loads, and groundwater load imposed, assuming existing pipe cannot share loading or contribute to structural integrity of liner.
- B. Design liner to least-possible thickness to minimize decreasing interior pipe diameter.
- C. Design liner material to provide jointless, continuous, and structurally sound construction able to withstand imposed static, dynamic, and hydrostatic loads on a long-term basis.
- D. Identify design provisions for shrinkage control to prevent future misalignment of service reconnections.

## 2.2 INVERTED, RESIN-IMPREGNATED TUBE PIPE LINER

- A. Furnish materials according to Manufacturer's standards.
- B. Description:
  - 1. Fabric Tube:
    - a. One or more layers of absorbent, non-woven felt fabric, felt/fiberglass, or fiberglass.
    - b. Comply with ASTM D5813, F1216, F1743, and F2019.
    - c. Capable of absorbing and carrying resins.
    - d. Comply with NASSCO Guidelines.
  - 2. Resin:
    - a. Corrosion-resistant polyester or vinyl ester resin and catalyst system.
    - b. Comply with ASTM F1216 and F1743.
    - c. The resin to tube ratio, by volume shall be furnished as recommended by the manufacturer.
  - 3. Wet-Out Fabric Tube:
    - a. Furnish uniform thickness and excess resin distribution that, when compressed at installation pressure, will meet or exceed design thickness after cure.
  - 4. Cure Tracking Technology
    - a. Continuous Temperature Monitoring and data collection shall be required during the CIPP process. To monitor the temperatures inside the tube wall and to verify proper curing, temperature sensors shall be placed between the host pipe and the liner in the bottom of the host pipe (invert) throughout the reach to record the heating and cooling that takes place on the outside of the liner during processing.

## 2.3 SECTIONAL INVERTED, RESIN IMPREGNATED TUBE PIPE LINER

- A. Furnish materials according to Manufacturer's standards.
- B. Description:
  - 1. The tube will consist of one or more layers of flexible coated non-woven needled felt or a reinforced non-woven. The tube will be continuous in length exhibiting a uniform minimum wall thickness based upon design calculations found in ASTM F1216 appendix XI. No overlapping sections shall be allowed in the circumference or the length of the liner. The tube shall include compressible material at each end forming a smooth transition to the host pipe. The liner will be capable of conforming to offset joints, bells, and disfigured pipe sections. The resin will be polyester, or vinyl-ester with proper catalysts as designed for the specific application. The cured-in-place pipe shall provide a smooth bore interior. Each installation shall have a design report documenting the design criteria for a fully deteriorated pipe section. The cured-in-place pipe shall meet or exceed the minimum test standards specified by the American Society for Testing Methods as described in the most current ASTM F1216 standard.
    - a. Flexural Strength ASTM D790 4,500 psi
    - b. Flexural Modulus ASTM D790 250,000 psi

## 2.4 SOURCE QUALITY CONTROL

- A. Inspect material for defects. Verify liner material is homogeneous and free of defects, cracks, holes, blisters, protrusions, foreign materials, or other deleterious faults.
- B. Marking:
  - 1. For testing purposes, mark each production lot with identical marking number.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify location of piping to be relined.

### 3.2 PREPARATION

- A. Cleaning: Clean existing pipes of debris, sedimentation, and mineral deposits with high-velocity cleaner, bucket and scraper, root saws, rolling or balling units, or other appropriate means.
- B. Initial Video Inspection and Repair:
  - 1. Conduct closed-circuit video inspection as specified in GDOT Specification 936 – CCTV.
  - 2. Determine condition of existing piping, degree of offset of joints, and locations of crushed walls and obstructions.
  - 3. Evaluation of pipe conditions, performed by pipeline assessor.
  - 4. Clear obstructions, service piping protrusions, and other materials from bottom of existing pipe to ensure that inserted pipe liner directly contacts existing pipe wall.
  - 5. It shall be the responsibility of the Installation Contractor to notify the Owner of line obstructions, offset joints or collapsed pipe that will prevent the insertion of the tube or significantly reduce the capacity of the sewer. The Owner, with input from the Installation Contractor, shall determine the method of pipe repair required and shall address these concerns on a case-by-case basis.
- C. Bypass pumping:
  - 1. Set up bypassing pump system to isolate each section of piping for relining, as deemed necessary.
  - 2. Maintain bypass pumping until lining is totally formed and connections have been reestablished.

### 3.3 INSTALLATION

- A. Excavate for point repairs only on emergency basis and as permitted by Engineer.
- B. Inverted, Resin-Impregnated Tube Pipe Liner:
  - 1. Coat layer of fabric tube (before inversion or pull-in, as applicable) with an impermeable, flexible membrane that will contain resin and facilitate, if applicable, vacuum impregnation and monitoring of resin saturation during resin impregnation (wet-out) procedure.
  - 2. Prior to installation, and as recommended by manufacturer, place remote temperature gages or sensors inside host pipe at 6 o'clock position to monitor temperature during cure cycle.
  - 3. Positioning:

- a. Position wet-out tube in pipeline using method specified by manufacturer.
  - b. Do not damage tube during installation.
4. Cure installed liner by using appropriate medium according to manufacturer's recommended cure schedule.
5. Allow installed pipe liner to cool according to manufacturer instructions.
6. Annular Spaces:
  - a. Verify that no gap or annular space exists between finished liner and existing pipe.
  - b. Install watertight seals to host pipe at beginning and end of installed liner.

C. Sectional Inverted, Rein Impregnated Tube Pipe Liner:

1. Installation procedure shall conform to ASTM F2599 "Standard Practice for Sectional Repair of Damaged Pipe by Means of an Inverted Cured-In-Place Liner."
2. When required, the flow shall be by-passed. The pumping system will be sufficiently sized for normal to peak flow conditions.
3. Installer will clean and inspect the line using a pan/tilt camera capable of verifying active or inactive service connections and the overall structural condition of the pipeline. All roots, debris, and protruding service connections will be removed prior to reconstruction of the pipe segment.
4. The tube shall be inspected for tears or frayed sections.
5. The saturated tube along with the inversion bladder will be inserted into a flexible inversion launcher device. The inversion launching device is pulled into the pipe using a cable winch. The pull is complete when the end of the launching device is aligned with the beginning of the damaged pipe section. The resin and tube are completely protected during the pull. No resin shall be lost by contact with manhole walls or the pipe during the pull. The resin that provides a structural liner shall not contact the pipe until positioned at the point of repair. The resin should not be contaminated or diluted by exposure to dirt, debris, or water during the pull.
6. The installer shall be capable of viewing the beginning of the liner contacting the host pipe verifying the exact placement of the liner. Video documentation of the placement, prior to curing, shall be provided to the owner. No measuring from a CCTV counter or estimating will be allowed. The liner must be installed at low pressure to prevent damage or further damage to the host pipe.
7. The tube will be inverted out of the inversion launching device by controlled air pressure. The installer shall be capable of viewing the entire liner contacting the host pipe from the beginning to the end of the liner verifying the liner has covered the entire damaged section. Video documentation of the entire liner contacting the host pipe, prior to curing shall be provided to the owner. The tube is held tightly in place against the wall of the host pipe by the pressure until the cure is complete.
8. When the curing process is complete, the pressure will be released. The inflation bladder and launching device shall be removed from the host pipe with the winch. No barriers, coatings, or any material other than the cured tube/resin composite, specifically designed for desirable physical and chemical resistance properties, should ever be left in the host pipe. Any materials used in the installation other than the cured tube/resin composite must be removed from the pipe by installer.
9. A second CCTV inspection is performed to verify the proper cure of the material, the proper opening of service laterals, and the integrity of the seamless pipe. The owner will receive video recording documenting the inspection and a written report documenting the repair.
10. Testing and Acceptance:



- a. Upon completion, the installer will deliver a digital video recording and report describing the repair to the owner.

### 3.4 FIELD QUALITY CONTROL

#### A. Liner Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. If liner fails to form, remove failed liner and install new liner.
3. Conduct closed-circuit video inspection of completed relining Work, indicating no visual defects, including foreign inclusions, dry spots, pinholes, cracks, delamination, wrinkles/fins that interface with flow, or bulging.
4. Confirm that service connections are complete and unobstructed.
5. No infiltration of groundwater is permitted.
6. Make final adjustments to liner under direction of manufacturer's representative.

#### B. Testing:

1. Contractor shall prepare each pipe/sewer scheduled for cured-in-place lining for end sampling, or as directed by the Engineer.
2. Selected samples shall be tested by a 3<sup>rd</sup> party testing agency qualified to perform said work.
3. Contractor shall be responsible for all costs associated with sampling and testing.
4. Tests shall be conducted on flexural modulus, flexural strength and wall thickness per ASTM D790.

#### C. Furnish installation certificate from manufacturer's representative attesting that liner has been properly installed and is ready for startup and testing.

END OF SECTION